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EVALUATION OF ECOLOGICAL CONSTRAINTS ON PEAT MINING IN NEW BRUNSWICK

I. WATERFOWL POPULATION SURVEY

II. MOOSE POPULATION SURVEY

by

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INTRODUCTION

Horticultural peat mining is a major natural resource based industry in eastern New Brunswick. Peat extraction is administered by the Department of Natural Resources and Energy under the Quarriable Substances Act and Peatland Policy.

The largest peat bog complex in New Brunswick is located in the Escuminac Peninsula. The area has extensive reserves of high quality sphagnum peat moss which make it attractive for development. At present, five companies operate crown leases in the area and furthermore, several resource development projects have been proposed.

In view of this development pressure, Fish and Wildlife biologists have expressed concern regarding the potential impact of peat mining activities on wildlife, more specifically on moose and waterfowl usage. Though wildlife species diversity and abundance are low in peatlands compared to other wetland types, or ecosystems on mineral soils, large numbers of migratory waterfowl utilize inland and coastal peatlands as staging and resting areas during migration. As well, several important big game species including moose are seasonally dependant on peatland habitats, the extent of which depends on several factors such as climate, topography and drainage, size, vegetational structure and composition (IEC Beak Consultants).

Although use of peatlands by wildlife has been documented, quantitative research efforts have been limited. Lack of specific, quantitative data on moose and waterfowl use result in difficulty

in properly assessing peat extraction demands in terms of the potential impacts extraction activities might have.

This project was undertaken to obtain base-line information on moose and waterfowl usage of peatlands in the Escuminac bog complex in order to determine the impact of existing peat mining activities and thus, assist managers in making decisions regarding further resource development demands.

PART I. WATERFOWL POPULATION SURVEY

1.0 BACKGROUND

The Escuminac bog complex comprises a relatively large number of fresh water ponds. Such ponds in other bog complexes support breeding populations of American Black Duck, Ring-necked Duck and Green-winged Teal. Bog ponds are also used by larger numbers of staging waterfowl such as Canada Geese and Black Duck during spring and fall migration.

Drainage of fresh water ponds associated with the commercial extraction of peat in other bog complexes has resulted in public complaints about loss of waterfowl habitat and diminished hunting opportunity. The importance of such bog complexes to local breeding populations of waterfowl and as staging areas has yet to be quantified.

2.0 OBJECTIVES

The study had two objectives:

- to conduct aerial surveys to quantify the use of bog ponds by waterfowl as pairing, brood rearing and staging areas, and

- to determine changes in their level of use of such areas as a result of peat extraction.

3.0 ACTIVITIES

Seven aerial surveys were conducted by fixed-wing aircraft (Cessna C-172) during specified periods over the season:

- two for breeding pairs on May 17th and 26th, 1989;
- two for broods on June 27th and July 24th, 1989;
- three to observe staging and migration use on September 20th and October 11th and 27th, 1989.

3.1 Survey plot selection

Six 2 x 2 km plots were chosen to carry out the study, bearing in mind proximity to peat mining operations and inclusion of a maximum number of ponds. Three experimental plots were defined near mining operations, while the remaining three were control plots, selected in undisturbed surroundings (Figure I-1).

Four of the plots were located within the Escuminac Peninsula: two control and two experimental (Figure I-2). An additional experimental plot was located on Tabusintac Blacklands (Figure I-3) and a third control on Lambert Barren (Figure I-4). Particulars on these plots are given in the following section.

3.2 Description of control plots

Control 1 - Eel River Bridge

Located approximately 7 km due south of Baie-Ste-Anne and southeast of the Thériault & Hachey plot, to which it is adjacent. Surrounded by peatlands. Has many medium to large ponds, several being very large, scattered on most of the area except the upper northwest corner. Several ponds drain into Portage River in the north and another into East Branch Eel River (west). The area is also drained by tributaries of Rivière au Portage to the south and Rivière à l'Anguille to the east. (Bog #324W, aerial photo DNR 83508 50)

Control 2 - Baie-Ste-Anne

Situated 2.5 km SSW of Baie-Ste-Anne. Has numerous medium to large ponds, a few very large, scattered on surface of plot, however southwest quarter is almost devoid of ponds. Area drains into East Branch Portage River to the west. A peat exploration licence (87-2) has been issued in this area.
(Bog #324N, aerial photo DNR 83508 134)

Control 3 - Lambert Barren

Approximately 5 km south of New Bandon. Plot encompasses the whole bog which is about 2 x 1.5 km. Secluded area surrounded by forest, dotted with numerous medium to fairly large ponds, mainly on the southern half. Area drains into Pokeshaw River to the north. An exploration licence (88-1) has been granted on this bog. (Bog #552, aerial photo DNR 85507-10)

3.3 Description of experimental plots

Thériault & Hachey (Eel River Bridge)

Located approximately 4 km due south of Manuels. Northern and western sides of the plot are bordered by forest, while the bog complex continues on both other sides. A mining operation occupies most of the central portion of the plot, occupying from one-third to one-half of total area. Packing plant and two access roads are inside the plot extending slightly beyond the middle of line 1. Many medium-sized ponds and several very large, mostly in southern half. Pond areas in mined sector have generally been avoided by operators. (Bog #324W, aerial photo DNR 83505 103)

ASB - Pointe-Sapin

Situated about 1.5 km northwest of Pointe-Sapin, on the eastern tip of bog #324E. Two-thirds of the plot is on the ASB lease, however only the eastern side is developed for peat extraction, most of the mined area being outside the plot. Packing plant is 0.5 km from southern edge. Mainly medium to large ponds are scattered on most of the unmined area. Most of the ponds on the mined part of the plot, several being very large, have been drained completely. (Bog #324E, aerial photo DNR 83508 56)

Heveco - Tabusintac

Located in Blacklands, southeast of Tabusintac, this plot borders Tabusintac Bay. Mined portion makes up less than one-quarter of plot and extends across the northern edge and about halfway down the eastern edge. Very numerous medium to medium-

large ponds on all but the mined areas and the southeastern corner. This area has a long waterfowl hunting tradition. Particular interest in this bog results from public complaints about lost waterfowl habitat. (Bog #524, aerial plots DNR 84507 200)

3.4 Flight plans

Survey date windows were established at the onset of the project, most of the seven flights being carried out on the first favorable day. An eighth anticipated flight was dropped to allow the addition of two plots outside the Escuminac Peninsula.

Flight procedures were essentially as described by Goldsberry. Accordingly, 5 transects 400 m apart and oriented north-south were flown on each plot, the first and last being 200 m from the west and east boundaries respectively.

Flights were chartered with Air New Brunswick of Bathurst. Plans were discussed with the pilot prior to surveys; as well coordinates for the first line end points in each plot were entered into the Loran C navigation system. Three observers participated in each survey. Al Hanson acted as navigator on all flights and collected observations on transparencies over aerial photos. Average flight duration was 3.2 hours.

4.0 RESULTS

Survey observations are summarized in Tables 1 to 9 (see Annex). Tables 1 to 3 group together data per survey type, while Tables 4 to 9 compile data from all surveys for individual plots. Sub-tables within text extract specific information from the above-mentionned tables.

4.1 Breeding pair surveys (Table I-1 Annex A)

Two surveys were flown, the first on May 17th and the second on the 26th. Survey date window for the first flight, originally scheduled between May 1-5th, was delayed one week because of ice present on bog ponds and further another week as persistent fog conditions along the coast reduced visibility considerably. This delay along with inclement weather also pushed back the second flight set for May 5-10th.

Five species of ducks were observed. These are, in decreasing order of numbers sighted, Ring-necked Duck (RnD), Black Duck (BD), Common Merganser (CM), Pintail (P), and Common Goldeneye (G). (Table I-1.1)

Table I-1.1 Total sightings per survey

	Survey 1		Survey 2	
	#	%	#	%
RnD	43	59	24	40
BD	23	32	24	40
CM	4	5	8	13
P	3	4	3	5
G	-	-	1	2

Approximately the same number of observations were made on control and experimental plots (Table I-1.2)

Table I-1.2 Total sightings on control vs experimental plots

	Control		Experimental		Total
	#	%	#	%	#
Survey 1	39	53	34	47	73
Survey 2	31	52	29	48	60

Control 3 (Lambert Barren) and one experimental, ASB, were approximately tied for the most observations.

4.1.1 Ring-necked Duck

The Ring-necked Duck was the most numerous species present during the first survey (43 individuals, 16 pairs) and was equal to Black Duck observations for the second (24 individuals, 7 pairs). Sightings were made on all plots, however only one bird was seen on the Thériault & Hachey plot. Table I-1.3 compares the combined observations on control plots versus experimental plots.

Table I-1.3 Ring-necked Duck sightings

	Control		Experimental		Total	
	#	Pairs	#	Pairs	#	Pairs
Survey 1	25	10	18	6	43	16
Survey 2	18	5	6	2	24	7

These figures seem to suggest a slightly higher usage of control plots, however this is not necessarily so, as the second most productive plot was an experimental (ASB).

4.1.2 Black Duck

Black Ducks were present on all plots on both surveys except for the last on Thériault & Hachey. They were second in numbers to Ring-necked Duck on the first survey and equal to these on the second.

Experimental and control plots had an equal number of observations on Survey 1, while on Survey 2, more sightings were made in the experimental group (Table I-1.4).

Table I-1.4 Black Duck sightings

	Control		Experimental		Total	
	#	Pairs	#	Pairs	#	Pairs
Survey 1	12	3	11	3	23	6
Survey 2	8	1	16	3	24	4

Numbers of birds seen on each survey were comparable. Two broods were sighted on the second survey, one on a control plot, the other on an experimental plot.

Low Black Duck numbers could partly be due to lateness of surveys. The two broods sighted on the second flight suggest that more females could be incubating and thus not seen, while several males might have already left their territories.

4.1.3 Common Merganser

Common Mergansers were seen in small numbers in two out of three control and experimental plots. Sightings were made with approximately the same frequency in both groups (Table I-1.5).

Table I-1.5 Common Merganser sightings

	Control		Experimental		Total	
	#	Pairs	#	Pairs	#	Pairs
Survey 1	2	1	2	1	4	2
Survey 2	3	1	5	2	8	3

4.1.4 Pintail and Common Goldeneye

A few Pintails were observed on one plot in each category.

Table I-1.6 Pintail sightings

	Control		Experimental		Total	
	#	Pairs	#	Pairs	#	Pairs
Survey 1	0	0	3	1	3	1
Survey 2	1	0	2	1	3	1

A single Common Goldeneye was spotted on a control plot (Lambert Barren) on one of the surveys only (Table I-1.6).

4.2 Brood Surveys (Table I-2 Annex A)

Windows set for these surveys were June 20-25th and July 15-20th. Both flights were conducted close to scheduled dates (June 27th and July 27th).

Five species of ducks were sighted: Black Duck, Ring-necked Duck, Common Merganser, Mallard (M) and Widgeon (W). The 10 broods observed were mainly Black Duck (7 with possibility of 2 resightings), a few Ring-necked Duck (2) and one Widgeon. (Table I-2.1).

Table I-2.1 Total sightings per survey

	Survey 1				Survey 2			
	#	%	broods	%	#	%	broods	%
RnD	3	11	-	-	16	26	2	29
BD	6	21	2	67	36	58	5	71
CM	18	64	-	-	9	14	-	-
W	1	4	1	33	-	-	-	-
M	-	-	-	-	1	2	-	-

The first survey turned up 3 broods, all observed on the same control plot (Lambert Barren). These were 2 Black Duck broods (4 class IIB and 7 class IB) and 1 Widgeon brood (4 class IC).

On the following survey a total of 7 broods were observed: 4 Black Duck broods (2 class IIB, 1 class IIA, 4 class IIC, 4 class IIA) and one Ring-necked Duck brood (6 class IC), all on Lambert Barren and one Black Duck brood (5 class IIC), plus one Ring-necked Duck brood (8 class IB), both on ASB. These results point to very low brood-rearing activity, on all but one control plot.

The 4 Black Duck broods observed on Lambert Barren compared with the low number of pairs sighted during previous surveys (2 and 0) indicate that some pairs were missed, probably due to tardy survey dates.

The recorded number of pairs of the later nesting Ring-necked Duck, however, did not turn out a corresponding number of broods, which suggests these birds moved elsewhere to breed.

During both surveys, a larger number of individuals were found on experimental than on control plots (Table I-2.2). At this time, Ring-necked Ducks and Black Ducks were the most commonly seen, but both were generally in smaller numbers, except for a large group of Black Ducks on the Heveco plot.

Several Common Mergansers were seen, but almost solely on the Heveco plot.

Table I-2.2 Total sightings on control vs experimental plots

	Control		Experimental		Total	
	#	broods	#	broods	#	broods
Survey 1	5	3	23	0	28	3
Survey 2	22	5	40	2	62	7

4.3 Staging and migration surveys (Table I-3 Annex)

Three surveys were flown out of a possible four, as explained earlier. These took place on September 20th, October 11th and 27th.

During the migration period, a wider range of waterfowl species has been found to utilize bog ponds in the study area (Table I-3.1).

Table I-3.1 Total sightings per survey

	Survey 1		Survey 2		Survey 3	
	#	%	#	%	#	%
BD	94	49	16	11	-	-
RnD	62	32	75	51	15	18
CM	2	1	-	-	-	-
GwT	12	6	7	4	-	-
BwT	14	7	-	-	-	-
M	4	2	-	-	-	-
WD	6	3	6	4	-	-
G	-	-	44	30	70	82

These figures indicate that Black Duck and Ring-necked Duck are the foremost users during the migration period, with small numbers of Green-winged Teal (GwT), Blue-winged Teal (BwT), Wood Duck (WD), occasional Merganser and Mallard. Later on in the season, Canada Geese (CG) start coming through and have been found on one control (Lambert Barren) and one experimental (Thériault & Hachey).

The very few observations made during the October 27th survey seem to indicate that migration of duck species using this type of habitat was essentially over.

Table I-3.2 gives a breakdown of total sightings per plot group. Figures show a somewhat higher use of control plots by

ducks.

Table I-3.2 Total sightings on control vs experimental plots

	Control				Experimental				Total			
	Ducks		Geese		Ducks		Geese		Ducks		Geese	
	#	%	#	%	#	%	#	%	#	%	#	%
Survey 1	115	59	-	-	79	41	-	-	194	100	-	-
Survey 2	63	42	-	-	41	28	44	30	104	70	44	30
Survey 3	14	17	70	82	1	1	-	-	15	18	70	82

Table I-3.3 shows the total number of Black Duck and Ring-necked Duck observations on each migration survey per plot group. Both species were somewhat more numerous on the control group.

Table I-3.3 Black Duck and Ring-necked Duck observations

	Control			Experimental		
Surveys	1	2	3	1	2	3
BD	54	3	0	40	13	0
RnD	51	46	14	11	29	1

4.4 Comparative analysis - Control plots

4.4.1 Control 1 - Eel River Bridge (Table I-4 Annex A)

Breeding pair surveys showed low breeding activity with only one pair each of Black Duck, Ring-necked Duck and Common Merganser observed on first survey and none on the second.

No broods were sighted on this plot and 4 Ring-necked Ducks

were the only waterfowl observed on both brood surveys. Moderate usage was noted during migration, especially by Ring-necked Duck and Black Duck. A few Green-winged Teal, Blue-winged Teal, Wood Duck and Mallard were present, mainly on the first survey.

Table I-4.1 Migration survey results

Surveys	BD	RnD	GwT	BwT	M	WD
1	35	12	1	2	1	5
2	1	29	5	-	-	-
3	-	4	-	-	-	-

According to these observations, this plot was used essentially during the migration period.

4.4.2 Control 2 - Baie-Ste-Anne (Table I-5 Annex A)

All surveys showed use by Black Duck and Ring-necked Duck only. Breeding pair flights turned up 1 pair of Black Duck and a few of Ring-necked Duck. One Black Duck brood was seen on second pair survey, however none were noted on either brood flight.

Migration surveys indicated moderate to high use by Ring-necked Duck and low use by Black Duck.

Table I-5.1 Migration survey results

Surveys	BD	RnD
1	6	32
2	2	11
3	-	10

4.4.3 Control 3 - Lambert Barren (Table I-6 Annex A)

This plot, contrary to the other two controls, was definitely used for breeding activities by Black Duck and Ring-necked Duck. Two pairs Black Duck and 8 pairs Ring-necked Duck were sighted on first pair survey, while only 2 Ring-necked Duck pairs appeared on the second. Three broods (2 Black Duck, 1 Widgeon) were seen on first brood survey, while 5 (4 Black Duck, 1 Ring-necked Duck) were spotted on the second.

Less use was noted during migration than for other controls, except for Canada Geese on last survey.

Table I-6.1 Migration survey results

Surveys	BD	RnD	WD	CG
1	13	7	1	-
2	-	6	-	-
3	-	-	-	70

Of the three control plots, Control 3 (Lambert Barren) was the only one which showed significant breeding activity. Both other plots, however, had a larger number and variety of migrants, except for Canada Geese which were only seen on Control 3.

4.5 Comparative analysis - Experimental plots

4.5.1 Thériault & Hachey - Eel River Bridge (TableI-7 Annex A)

This site showed no breeding activity whatsoever. No pairs nor broods were observed on any of the surveys, a few lone Black Duck and a single Ring-necked Duck being the only observations. The area showed some use by several species, mostly Black Duck, Ring-necked Duck and Canada Goose during migration, though rather limited.

Table I-7.1 Migration survey results

Surveys	BD	RnD	CM	GwT	BwT	WD	CG
1	7	6	1	-	1	-	-
2	9	6	-	2	-	6	35
3	-	-	-	-	-	-	-

4.5.2 ASB - Pointe-Sapin (Table I-8 Annex A)

Some breeding activity appeared during both pair surveys, especially by Black Duck (2 and 1 pairs) and Ring-necked Duck (4 and 1 pairs). One pair each of Common Merganser and Pintail were also sighted.

One brood each for Black Duck and Ring-necked Duck were observed on the second brood survey. One Black Duck brood had been seen on the second pair survey.

Activity during migration was limited to Black Duck, Ring-necked Duck and a few Green-winged Teal.

Table I-8.1 Migration survey results

Surveys	BD	RnD	GwT
1	21	-	5
2	4	13	-
3	-	1	-

4.5.3 Heveco - Tabusintac (Table I-9 Annex A)

Four breeding pairs were sighted on each of the pair surveys: 1 Black Duck, 2 Ring-necked Duck and 1 Common Merganser on the first, and 2 Black Duck, 1 Ring-necked Duck and 1 Common Merganser on the second; however, no broods were observed on any survey. Several species were seen during migration in low to moderate numbers.

Table I-9.1 Migration survey results

Surveys	BD	RND	CM	GwT	BwT	M
1	12	5	1	6	11	3
2	-	10	-	-	-	-
3	-	-	-	-	-	-

Breeding pairs were observed on both ASB and Heveco, but broods were found only on the first. Black Duck, Ring-necked Duck and Green-winged Teal were found on all 3 experimental plots during migration. Several others appeared on one survey or another in low to moderate numbers, with a relatively large flock of Canada Geese on one plot. A larger central portion of the Thériault & Hachey plot is occupied by mining activities which could partially explain the few sightings.

4.6 Control vs Experimental plots

Table 10 combines total waterfowl sightings for control versus experimental plots for each survey.

Table I-10 - Total waterfowl observations

Surveys		Control			Experimental		
		#	Pairs	Broods	#	Pairs	Broods
Pair	1	39	14	-	34	11	-
	2	31	7	-	29	8	-
Brood	1	5	-	3	23	-	-
	2	22	-	5	40	-	2
Staging &	1	115	-	-	79	-	-
Migration	2	63	-	-	50(35*)	-	-
	3	14(70*)	-	-	1	-	-

* Canada Geese

From the above figures, approximately the same number of individuals and pairs were observed in both groups (all species) during the pair surveys. A larger number of individuals was seen on the experimental group during the brood surveys, however a few more broods were sighted on the control group. Generally more waterfowl seems to have passed through the control group during fall migration.

These numbers do not indicate a clear-cut difference between

the control and experimental groups. In fact, one experimental plot has been found to be more productive in terms of breeding activities than two of the controls. Generally, both groups have shown a low to moderate level of use. Certainly, a number of factors other than peat mining determine waterfowl usage, among these, location of the bog and proximity to more productive habitat, as well as the extent of drained areas in mined bogs and the availability of adequate ponded surfaces.

5.0 CONCLUSION

Results obtained from these surveys definitely indicate some waterfowl use of peat bog ponds; however, for most of the species observed, except for Black Duck and Ring-necked Duck, usage seems mostly limited to staging and migration. Although some pairs were observed, very few broods were subsequently seen, which suggests that little brood-rearing actually takes place. This could be expected, as ponds in bog habitat are generally considered relatively unproductive in terms of aquatic invertebrates.

Through all surveys, Black Duck and Ring-necked Duck have proved to be the most significant users of bog ponds. Although not the most productive habitat for these species, both have been found to breed and raise brood here, especially Black Duck.

According to the New Brunswick Waterfowl Breeding Pair surveys, conducted from 1986-1989 (Parker), the two above-mentioned species together make up from 61 to 70% of all waterfowl recorded. One plot in these surveys, comprising comparable bog habitat and located close to our Control 3 (Lambert Barren), has also shown consistent albeit moderately low use over the years by Black Duck, Ring-necked Duck and Green-winged Teal.

The surveys have shown that some areas get more waterfowl use than others, and this has not been shown to be related to peat mining activities. Actual mined areas were found to be virtually devoid of waterfowl, having little open water to offer. Peat mining certainly diminishes total area available; however, the mine sites examined in this study occupied relatively small portions of the

bogs, leaving large expanses of undisturbed terrain dotted with numerous various-sized ponds. This appears to be the case of one experimental plot, ASB, which was the most productive in terms of breeding activities in the Escuminac Peninsula.

As for timing of surveys, Parker suggests early May, whereas our surveys were conducted in mid and late May, for reasons which were explained earlier. Although this could have led to an underestimation of pairs, the small number of broods appears to confirm a low number of territorial pairs.

Notwithstanding what appears to be rather limited use, this habitat most probably contributes to fulfil certain waterfowl needs, particularly as staging areas especially during migration periods.

PART II - MOOSE POPULATION SURVEY

1.0 BACKGROUND

The Escuminac bog complex area supports a relatively productive moose population (Pers. comm., R. Currie). Studies of moose habitat use underline the need for undisturbed lowland areas for calving (Boer, 1987). Furthermore, wet lowland terrain becomes important during the summer, when cool damp areas are used by the animals to reduce physiological stress that results from warm seasonal temperatures (Allen et al, 1987). Peat extraction constitutes a disturbance with potentially negative consequences on moose populations.

2.0 OBJECTIVES

To complete a comparative assessment of a control area having no current peat extraction activities and an experimental area where peat extraction is occurring to determine:

(i) if there is a difference in moose usage of these two areas;

(ii) in the affirmative, if peat mining activities are the causative agent; and

(iii) if so, the extent of their impact.

3.0 ACTIVITIES

3.1 Selection of study areas

The Escuminac bog complex was selected as study site because of the extent of peat extraction activities already taking place and the potential for future development.

Two areas 100 km^2 each were defined to carry out the study. The Experimental area was chosen to be representative of bog habitat, to include functional peat mining operations and to avoid built-up areas.

The Control area was delineated with the following criteria in mind: same general vicinity as Experimental area and excluding bogs developed for peat mining, while also being representative of bog habitat in the area.

3.2 Description of study areas (Fig. II-1)

Experimental

Encompasses most of extensive bog #324, approximately one third of bog #337 and half of bog #304A. More than half of the area is covered by relatively open peatlands, while less than one fourth is wooded bog and the remaining fourth, wooded on mineral soil. The peatland area is covered by numerous small to large ponds as well as two lakes. Three peat mining operations are located at least in part within the area: Berger Mix (#337), Thériault & Hachey (#324W), and ASB Greenworld (#324E).

Control

Comprises several more or less open bogs, including bog #313, Hell's Gate Plain (#305), Blue Ridge Plain (#306) and part of Carrigan Plain (#323), as well as several smaller bogs. Open peatlands comprise approximately 10% of the area. Wooded lands

constitute the remainder, swamps and wooded bogs accounting for roughly half of these. The southeastern quarter plus one kilometer north of it are entirely within the boundaries of Kouchibouguac National Park.

3.3 Flight plans and search strategy

Four surveys by fixed-wing aircraft were planned to take place during periods of known moose usage of peatlands. Two surveys were scheduled for late spring during the peak calving period and another two, in late summer following hot weather spells. Plans also called for a winter population census to be conducted by helicopter in December or January.

The four scheduled fixed-wing flights were conducted with Air New Brunswick. The first two flights were held on June 6th and 13th, 1989 to assess the plots as spring moose calving areas. Utilization by moose during late summer was assessed on subsequent two flights held on August 24th and September 5th, 1989. Several attempts to fly earlier in August had to be postponed because of unsuitable weather or other reasons.

For fixed-wing surveys, each plot comprised 5 transects, oriented east-west and located 2 km apart (Fig. II-2). Coordinates for the first line end points were determined so these could be entered into the Loran C navigation system. Search strategy consisted of flying the transects and circling the perimeter of bogs and meadows as we came upon them. When moose were located, they were circled to get the total count as well as to determine sex and age if possible. Flight speed was approximately 100 km/hr

at an altitude of 60 m. Survey times were approximately one hour per plot and total flight time averaged 4.6 hours. Three observers participated in each survey.

The winter population census was carried out by helicopter on February 29th, 1989. Unsuitable weather conditions in early winter were mainly responsible for the delay.

For this survey, flight procedures were standardized to follow those used by the DNRE for its winter moose population censusing. Each 100 km^2 plot was divided into four 2.5 km x 10 km blocks (Fig. II-3). Four flight lines were delineated per block, the first and last being 312 m from block edges. Each flight line was 626 m from the next. UTM grid references for all flight lines were determined from 1:50,000 topographic maps and subsequently converted to latitude/longitude (Annex C). Search strategy and identification were essentially as described by Oswald (1982). Survey was conducted at a speed of 70-80 km/hr and altitude of 50-60 m. Average time spent per block was 30 minutes. Total flight time including ferrying and refuelling was 5.8 hours. Due to late start leading to time constraints, only 5 1/2 out of 8 blocks were completed. Two observers participated in the survey. Gerry Redmond acted as navigator for all surveys and collected observations on photocopies of topographic maps.

4.0 RESULTS AND DISCUSSION

4.1 Late Spring Surveys

The purpose of these surveys was to assess these peatlands as calving areas. During Survey 1 (Table II-1), five moose were sighted in the lower reaches of the Experimental plot. Among these were one female with single calf and one female with an adult of unknown sex. Two individuals were counted in the Control plot, one of which was a female which appeared to be pregnant. Observations were mostly made near shrubby vegetation, often at the perimeter of bogs, rather than in the extensive open areas.

On Survey 2 (Table II-2), two moose were seen on the Experimental plot, both on line 5. One of these was a female with a ratty-looking coat, which may be attributed to shedding or ticks. Six moose, one of which was a lone female, were observed on the Control plot. All moose seen during this survey were found in open areas associated with bogs.

From these observations, we were not able to detect a difference in the pattern of use between both study areas. In fact, on Survey 1, more sightings were made in the Experimental plot, while the opposite situation was observed on Survey 2.

Most moose observed during both surveys were in or near bogs. Areas associated with wet deciduous type meadows having forested borders also seemed attractive to moose.

4.2 Late summer surveys

Two surveys were conducted to assess late summer activity patterns. During the first (Table II-3), a cow with one calf were

spotted less than 1 km south of a peat extraction operation (Thériault & Hachey). Another female with one yearling male was sighted near the centre of an open marshy bog, approximately 2 km west of another peat operation (ASB Greenworld), to bring total sightings in the Experimental plot to four.

Two moose were seen in the Control plot; one unknown adult, in a forested area within a peatland and one adult male, feeding in the open near the centre of a small boggy marsh. Most of the bog ponds had considerable floating aquatic vegetation, some of which could be attractive as late summer moose forage. This survey was conducted following a two week period of relatively cool rainy weather, such that moose would probably not be subject to thermal stress.

On Survey 2, (Table II-4), the one and only moose observed was located in the Control plot. The area had received some frost in the past week and moose should be starting to enter into rut.

Here again, observations do not indicate a difference in the pattern of use between Experimental and Control plots, however surveys were conducted following much cooler weather than intended.

4.3 Moose harvest (1989)

Hunting statistics obtained from R. Currie, Regional Biologist, Miramichi Region, show seven kills to have been reported in the Control plot compared to one only in the Experimental plot (Table II-5). This can be partially explained by increased hunting pressure in the Control area, which is most probably perceived as more productive moose habitat. In fact, the Control is more

forested and has considerably less areas of extensive open peatlands than the Experimental. Its location near Kouchibouguac National Park could also contribute to heighten hunter expectations. The large proportion of male kills can at least partly be attributed to hunter bias toward males.

4.4 Winter population census

This survey was carried out on February 25th, 1989, which was later than anticipated due to unsuitable snow and general weather conditions during most of January and February (Table II-6 & II-7). No observations were made in the Experimental plot, while one lone bull and one track aggregate were sighted in the first block of the Control plot. Both sightings were made in forested areas, the aggregate criss-crossing a small river.

A late start entailing time constraints prevented the complete coverage of the study area, such that the lower half of the Control plot was not surveyed.

With these observations, winter population was estimated at 0.02 0.04 moose/km^2.

For comparative purposes, winter population estimates in the Lakestream Moose Study Area, located in south-central New Brunswick, are as follows (Redmond, 1990):

Year	Population estimate (moose/km^2)
1984	0,165 ± 0,055
1985	0,125 ± 0,038
1988	0,090 ± 0,040
1989	0,135 ± 0,050

Aerial surveys during winter were conducted in Kouchibouguac National Park from 1973 to 1977, in 1982 and 1985. These surveys were carried out to locate moose and deer wintering grounds in order to get a broad distribution of these ungulates in the Park. No population estimates have been made.

Over the years, three to four locations areas within our Control plot have had moose track concentrations. Worthy of mention is also the fact that deer have expanded their range northward since 1977, thus encroaching more and more on the moose range (M. Savoie, 1983).

5.0 CONCLUSION

The results of this study do not indicate a difference in the activity patterns of moose between the Experimental area, which has three active peat mining operations, and the Control area, which is in a natural state.

Number of moose sighted in each study area during the spring surveys were comparable. Little can be stated about moose usage of peatlands during hot weather periods, since the late summer surveys took place too late in the season.

As for the winter survey, the few observations may suggest that moose have moved to more covered locations. Failure to census the Control plot completely on this survey could have resulted in fewer sightings. In fact, no observations were made in the Experimental plot, wich consists to a large extent of open peatlands. On the other hand, moose activity was seen in forested areas of the first block in the Control plot.

It might be pointed out that observer efficiency, however, was possibly greater in the Experimental plot, due to the large proportion of open peatlands.

According to the 1989 hunting statistics, the Control plot appears to be used quite heavily during the moose hunting season. This factor should be taken into consideration in future management plans.

Moose usage of the Experimental plot appears to be greater in the late spring and summer than in winter. Overall most moose sightings were made in shrubby vegetation associated with bog

edges. Moose were not sighted far out in the open peatland areas, however, one female with calf were spotted within one kilometer of a peat extraction site. This suggests that moose can venture quite close to active mining operations, probably around the wooded borders.

GENERAL CONCLUSION

The waterfowl component of this study has shown that utilization of peatland ponds is mostly limited to staging during migration periods for most of the species observed. In some areas, such as Tabusintac Blacklands, peatlands are considered productive hunting areas and have a long history associated with this sport.

Survey results indicate, however, that Black Duck and Ring-necked Duck do breed and raise brood in peatland ponds, though in fairly small numbers. These two species only were present constantly from spring to fall.

Observations have not shown a difference in usage of sites located in proximity to peat mining operations compared to control sites. In certain cases, those close to mining operations were actually more productive. However, it must be specified that no waterfowl were observed on the actual mining sites.

It would thus appear that at the moment peat mining activities in the Escuminac Peninsula would not have a detrimental effect on overall waterfowl usage.

The moose component of the study has shown both experimental and control areas to receive moose usage. Observations were greatest in number during the spring surveys and approximately equal in both study areas. Summer use could not be estimated adequately, however observations dwindled down in late summer. Winter use of open peatlands appeared very limited; the few observations made were located in forest cover.

Overall, no difference was detected in activity patterns during spring and late summer usage between the Experimental and Control areas. The difference in winter usage could be largely attributed to lack of cover in the Experimental area, rather than to peat mining activities.

RESUME

La péninsule d'Escuminac comprend la plus vaste étendue de tourbières au Nouveau-Brunswick. On y retrouve d'importantes réserves de tourbe de sphaigne de haute qualité, qui en font une région toute indiquée pour l'exploitation de tourbe horticole. A l'heure actuelle, cinq compagnies détiennent des droits d'exploitation dans la région et plusieurs autres projets visant le développement de cette ressource naturelle sont à l'étude.

La production de tourbe implique le drainage des tourbières et l'extraction. Des biologistes responsables de la pêche sportive et de la chasse ont exprimé leur crainte quant à l'impact de cette pratique sur la faune environnante, notamment sur l'orignal et la sauvagine. Quoique la fréquentation des tourbières par ces espèces soit chose connue, l'importance relative de cet habitat pour les diverses espèces n'a pas été évaluée. C'est dans cette optique qu'a été réalisée cette étude; dresser un tableau plus juste de l'utilisation des tourbières par la faune et évaluer l'impact potentiel de l'extraction de la tourbe sur cette utilisation.

La présente étude comporte deux volets, dont le premier examine l'utilisation par la sauvagine des étangs situés sur les tourbières. Le travail consistait essentiellement à effectuer des vols d'avion à basse altitude au-dessus de six sites, dont trois contrôles et trois expérimentaux, afin de faire le dénombrement et l'identification des espèces observées. Les vols furent effectués sur trois périodes de l'année: deux au printemps, pendant la période de formation des couples; deux en été, pour observer les

nichées; et trois à l'automne, pendant la période migratoire.

Les résultats de cette étude ont démontré que certains des étangs étaient fréquentés par la sauvagine. Cependant, pour la plupart des espèces observées, l'utilisation semble se limiter à la période migratoire, durant laquelle on a observé le plus grand nombre d'individus et la plus grande variété d'espèces.

Quoique plusieurs couples de diverses espèces furent observés, le petit nombre de nichées semble indiquer peu d'activité de reproduction. Cette constatation n'était guère surprenante étant donné que les étangs des tourbières ombrotrophes sont généralement considérés des habitats peu productifs en invertébrés aquatiques.

Lors de tous les vols, le canard noir et le morillon à collier constituaient les espèces les plus fréquemment observées. Tous deux se reproduisent et élèvent des nichées dans ce milieu, quoiqu'en petits nombres. Ces deux espèces étaient les seules à être présentes du printemps jusqu'à l'automne.

Nos observations n'ont pas permis de déceler une différence dans l'utilisation des sites à proximité de tourbières exploitées comparés aux sites contrôles. Certains se sont avérés plus fréquentés que d'autres, mais ceci n'a pu être relié aux activités d'extraction de la tourbe. Dans certains cas, les sites situés près des exploitations étaient plus productifs que les sites contrôles. Tel était le cas, notamment dans la région du site expérimental ASB qui, malgré l'exploitation de la tourbe, s'est avéré le site le plus productif parmi ceux de la péninsule d'Escuminac en ce qui a trait aux activités de reproduction.

Cependant, notons qu'aucune observation n'a été faite sur les portions de tourbières en exploitation active. A l'heure actuelle, étant donné que les exploitations n'occupent qu'une partie relativement petite des tourbières, de grandes superficies de terrain vierge parsemé de nombreux étangs de dimensions variables restent donc disponibles à la sauvagine.

Quoique les ressources y sont limitées, cet habitat semble combler certains besoins de la sauvagine, surtout comme aires de repos lors des migrations.

Certes, plusieurs facteurs autres que l'exploitation de la tourbe déterminent l'utilisation par la sauvagine; entre autres, la localisation de la tourbière et sa proximité à un habitat plus productif, ainsi que l'étendue des surfaces soumises au drainage et la disponibilité d'aires propices dans la région avoisinante.

Le deuxième volet de l'étude s'est penché sur l'utilisation des tourbières par les orignaux, qui fréquentent les terres basses humides au moment du vêlage, ainsi que lors des périodes de chaleur estivales, afin de réduire le stress physiologique causé par les températures élevées.

Ce volet a comporté le survol à basse altitude d'un site expérimental et d'un contrôle (100 km^2 chacun) afin de dénombrer les individus observés et d'en déterminer le sexe et l'âge. Quatre vols furent effectués en avion; deux tard au printemps et deux à la fin de l'été, tandis qu'un recensement de la population avait lieu en hélicoptère en fin février. Des statistiques sur la chasse dans cette région furent également recueillies.

Les résultats de cette étude n'ont pas permis de déceler une différence entre l'utilisation par l'orignal du site expérimental, qui comprenait trois tourbières en production, et le site contrôle.

Lors des vols printaniers, un nombre équivalent d'individus furent observés dans les deux sites. L'utilisation pendant les périodes de chaleur estivales n'a pu être vérifié, étant donné le retard dans nos vols occasionné par une température pluvieuse et fraîche. Toutefois, nous pouvons affirmer que l'usage en fin d'été semblait généralement moindre qu'au printemps pour les deux sites.

Le peu d'observations faites lors du vol d'hiver semble suggérer que les orignaux se soient déplacés vers des endroits offrant un meilleur abri. Cependant, en raison de contraintes de temps, le site contrôle n'a pu être survolé en entier, ce qui aurait pu entraîner une sous-estimation dans le nombre d'observations.

Les statistiques de chasse de 1989 démontrent un usage assez élevé du site contrôle pendant la saison de chasse à l'orignal. En effet, sept abats étaient rapportés sur ce site contre un seulement sur le site expérimental. Il semblerait que le premier soit l'objet d'un effort de chasse plus élevé, probablement dû au fait qu'il soit généralement perçu comme étant plus productif, étant plus boisé et à proximité du parc national Kouchibouguac.

Selon nos résultats, l'utilisation du site expérimental semble plus élevé au printemps et en été que pendant l'hiver, où aucun animal fut observé, malgré un effort d'observation accru en raison de la méthode de vol.

De façon générale la majorité des orignaux observés se trouvaient en bordure de tourbières, le plus souvent dans les zones de végétation arbustive; jamais dans les grandes étendues non-boisées des tourbières. Il est toutefois important de noter qu'une femelle et son veau furent observés à moins d'un kilomètre du site d'exploitation de Thériault et Hachey. Cette observation démontre que les orignaux peuvent effectivement s'approcher des tourbières en exploitation, probablement dans les régions boisées qui les entourent.

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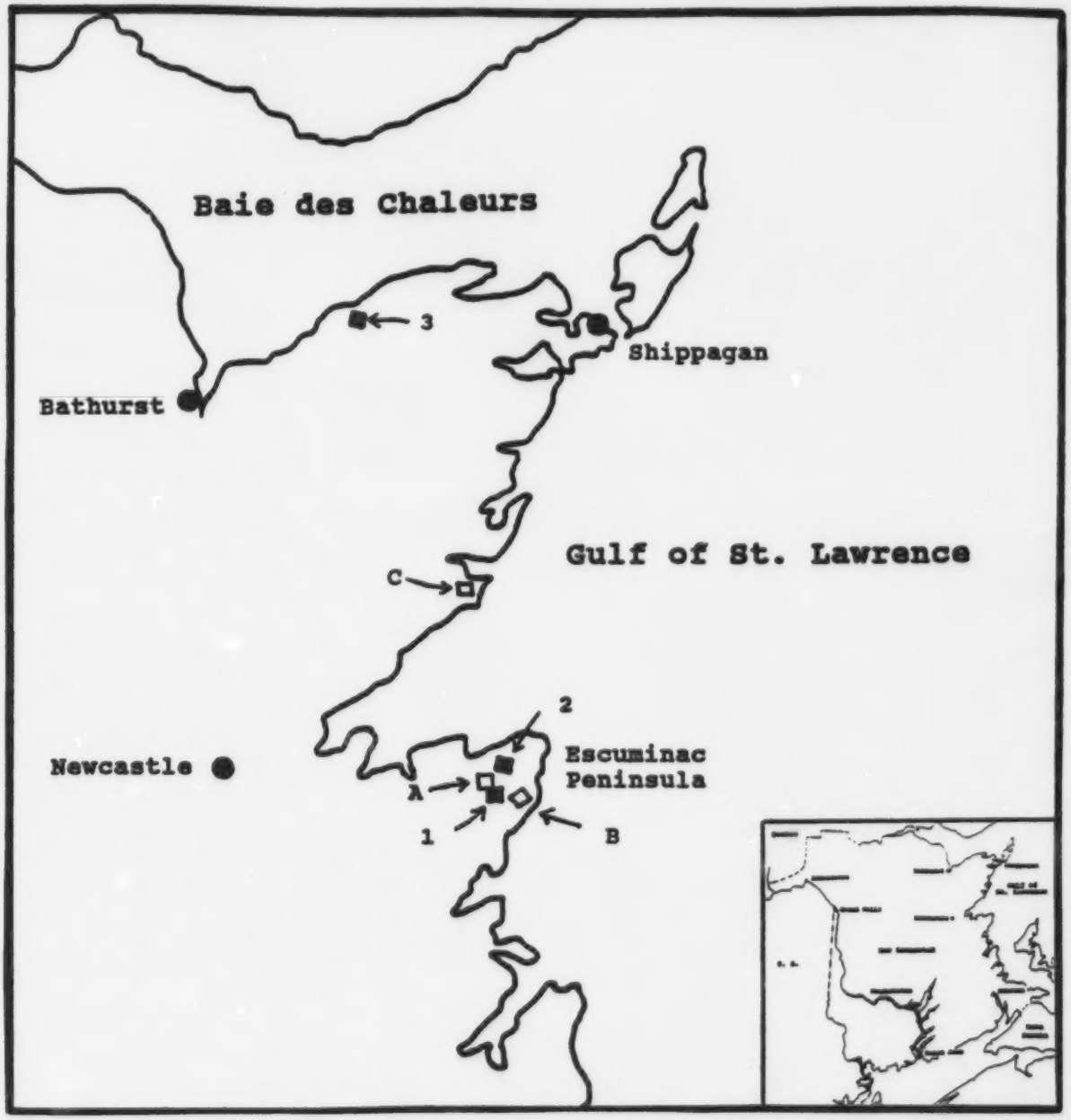
ANNEX A

FIGURES

FIGURE I-1 LOCATION OF WATERFOWL SURVEY PLOTS



■ CONTROL PLOTS

1- Eel River Bridge

2- Baie-Ste-Anne

3- Lambert Barren

□ EXPERIMENTAL PLOTS

A- Thériault & Hachey (Eel River Bridge)

B- ASB (Pointe-Sapin)

C- Heveco (Tabusintac)

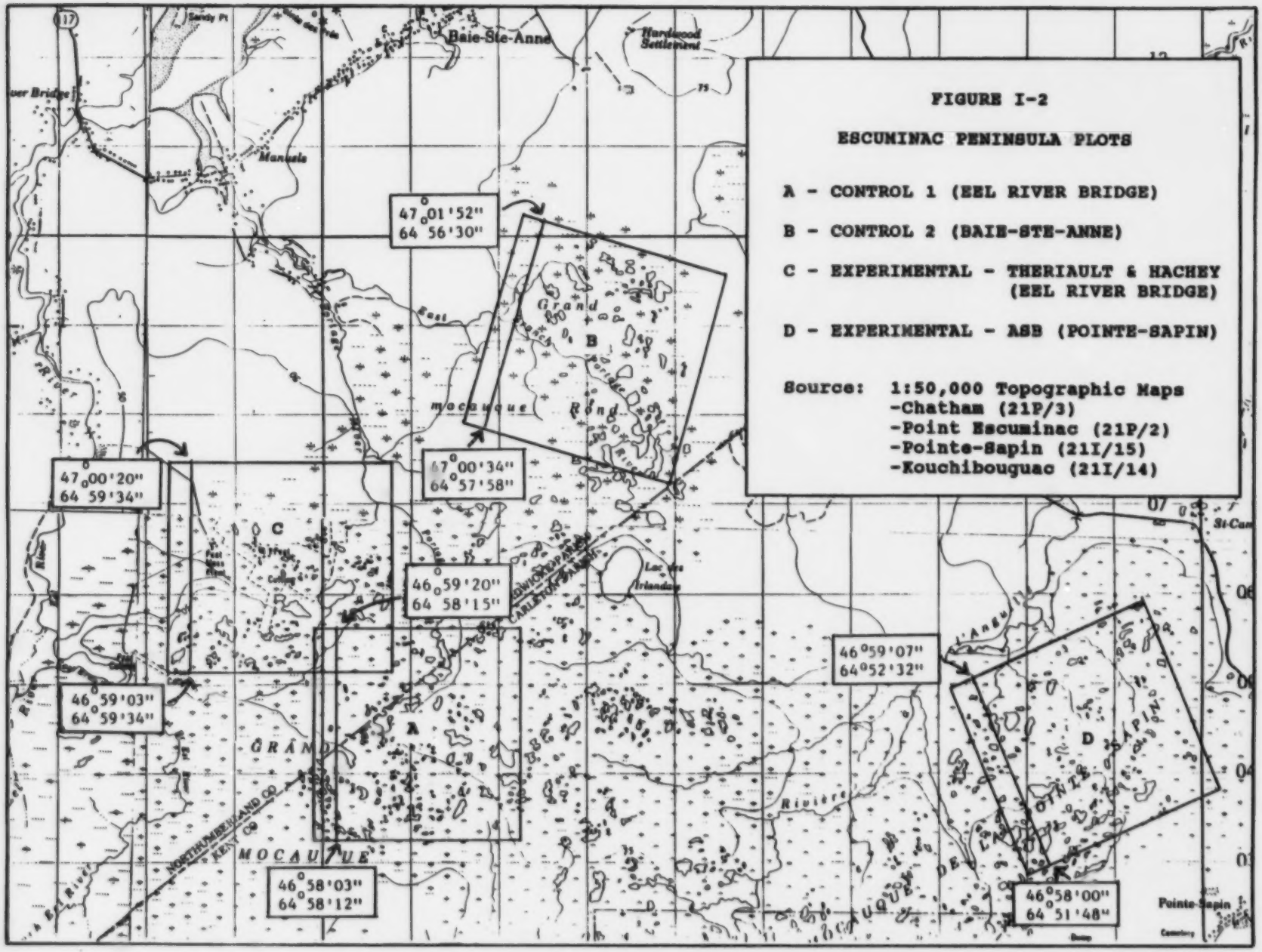


FIGURE I-2

ESCUMINAC PENINSULA PLOTS

A - CONTROL 1 (EEL RIVER BRIDGE)

B - CONTROL 2 (BAIE-STE-ANNE)

C - EXPERIMENTAL - THERIAULT & HACHEY (EEL RIVER BRIDGE)

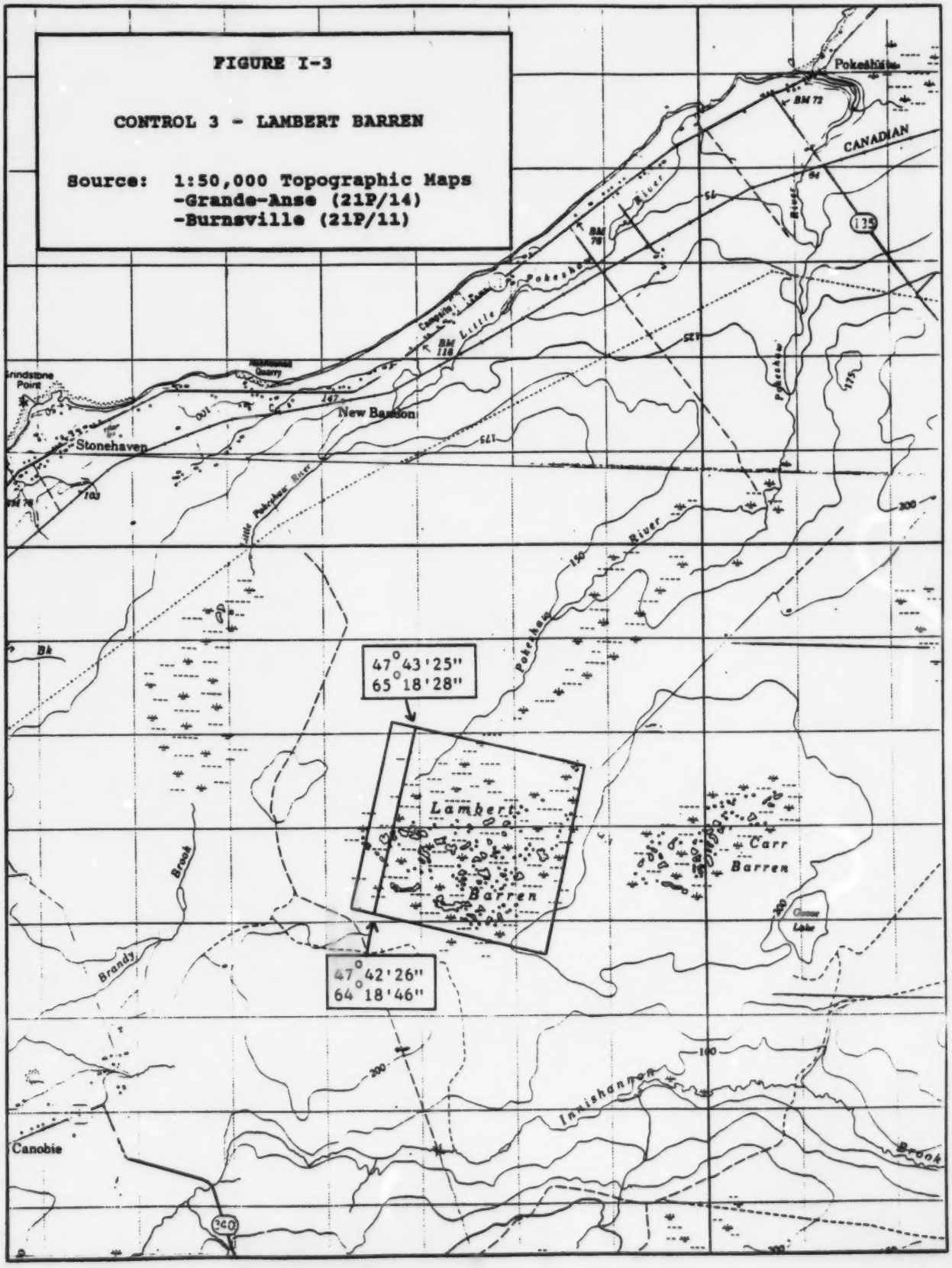
D - EXPERIMENTAL - ASB (POINTE-SAPIN)

Source: 1:50,000 Topographic Maps
-Chatham (21P/3)
-Point Escuminac (21P/2)
-Pointe-Sapin (21I/15)
-Kouchibouguac (21I/14)

FIGURE I-3

CONTROL 3 - LAMBERT BARREN

Source: 1:50,000 Topographic Maps
-Grande-Anse (21P/14)
-Burnsville (21P/11)



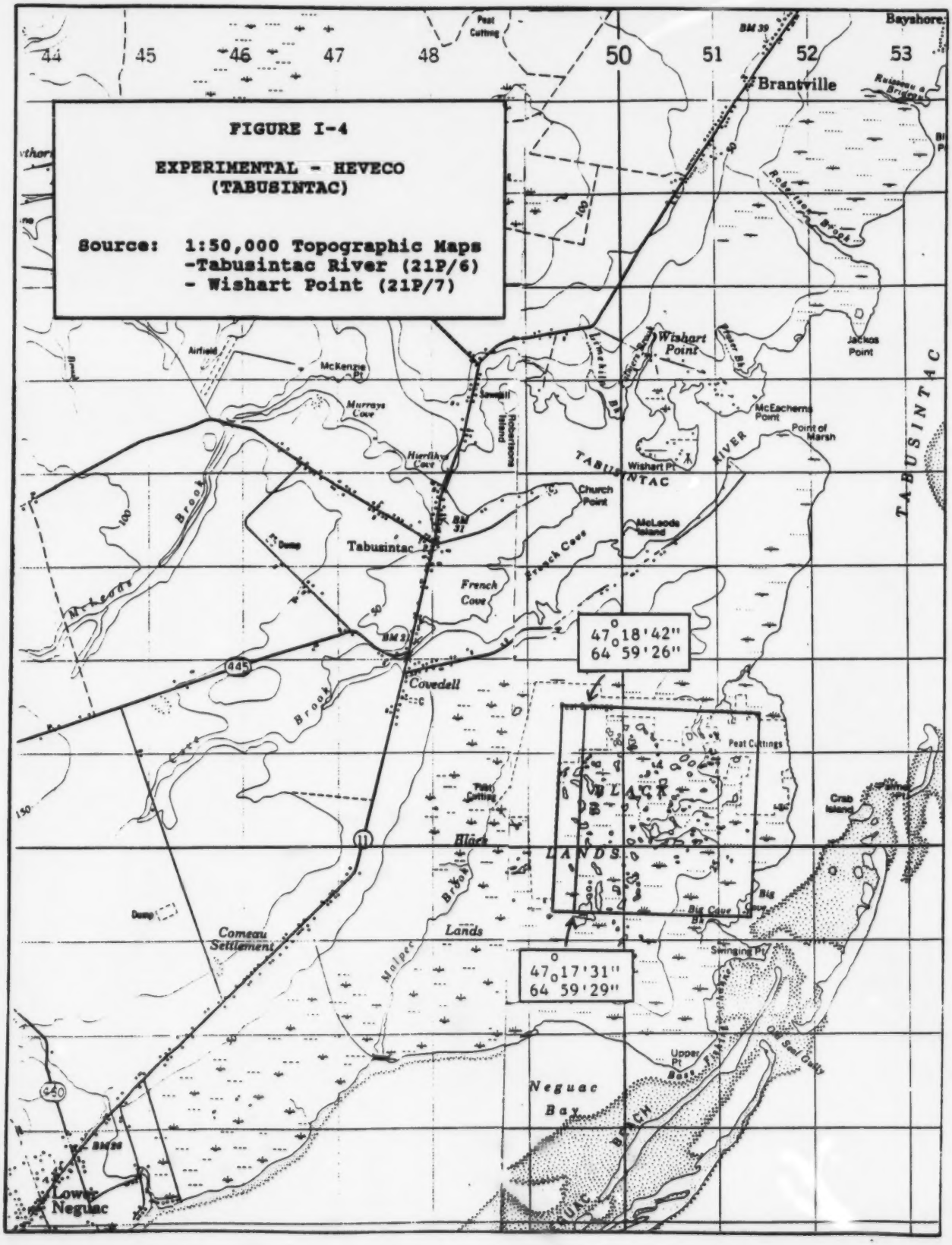


FIGURE I-4
EXPERIMENTAL - HEVECO
(TABUSINTAC)
Source: 1:50,000 Topographic Maps
-Tabusintac River (21P/6)
- Wishart Point (21P/7)
44
45
46
47
48
50
51
52
53
Bayshore
Brantville
Peat Cutting
BM 39
Wishart Point
Jackos Point
McKenna Pt
Murrays Cove
Sawmill
Robertsons Island
McEacherns Point
Point of Marsh
Hurrihys Cove
Wishart Pt
TABUSINTAC RIVER
TABUSINTAC
Church Point
McLeods Island
BM 31
Tabusintac
French Cove
47°18'42"
64°59'26"
Covedell
445
BM 21
Peat Cuttings
BLACK
LANDS
Crab Island
Black Brook
Big Cove
Swinging Pt
Comeau Settlement
Malpec Brook
Lands
47°17'31"
64°59'29"
Upper Pt
Old Seal Gully
Neguac Bay
NEGUAC BEACH
450
Lower Neguac

FIGURE II-1 - LOCATION OF MOOSE STUDY AREAS

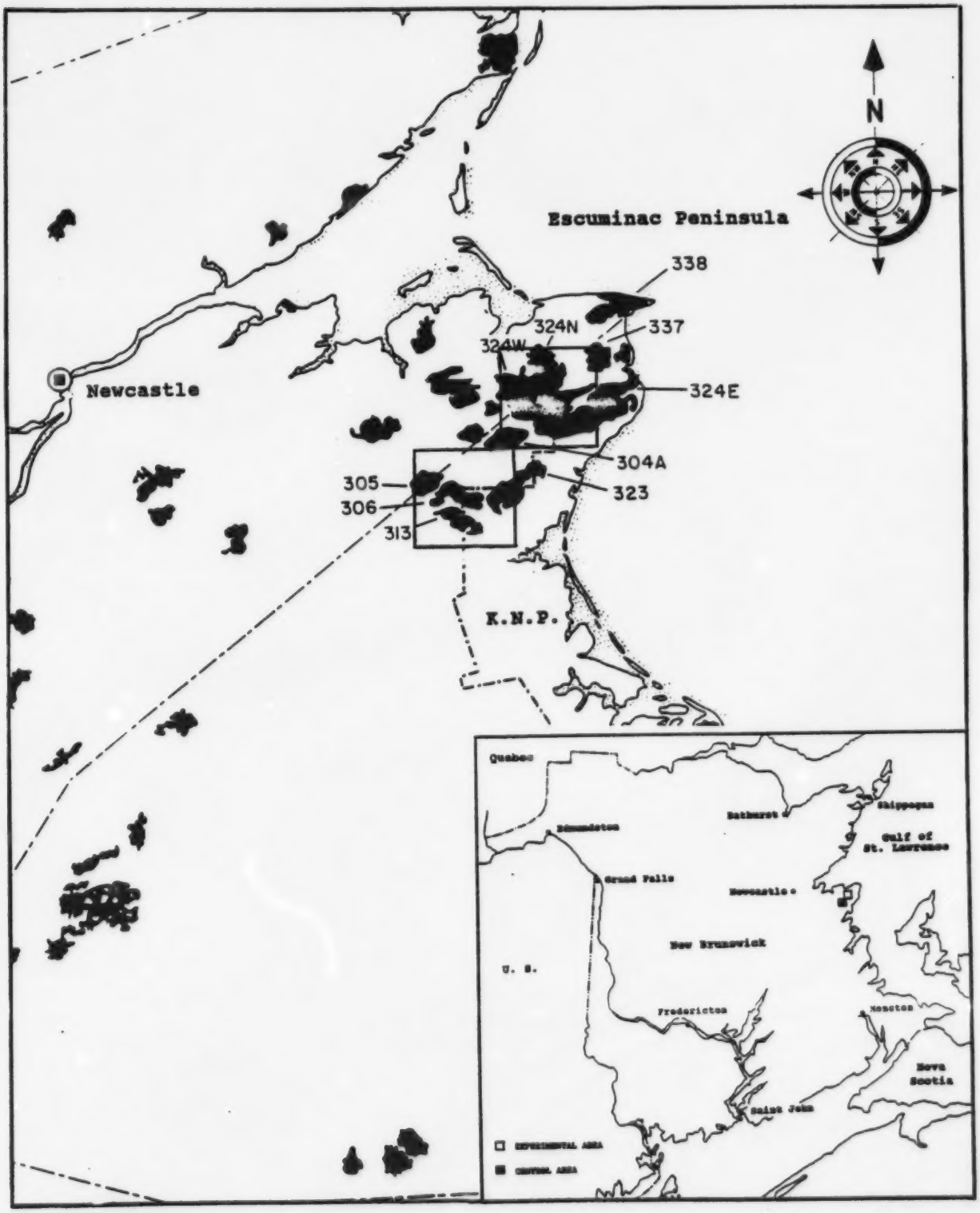
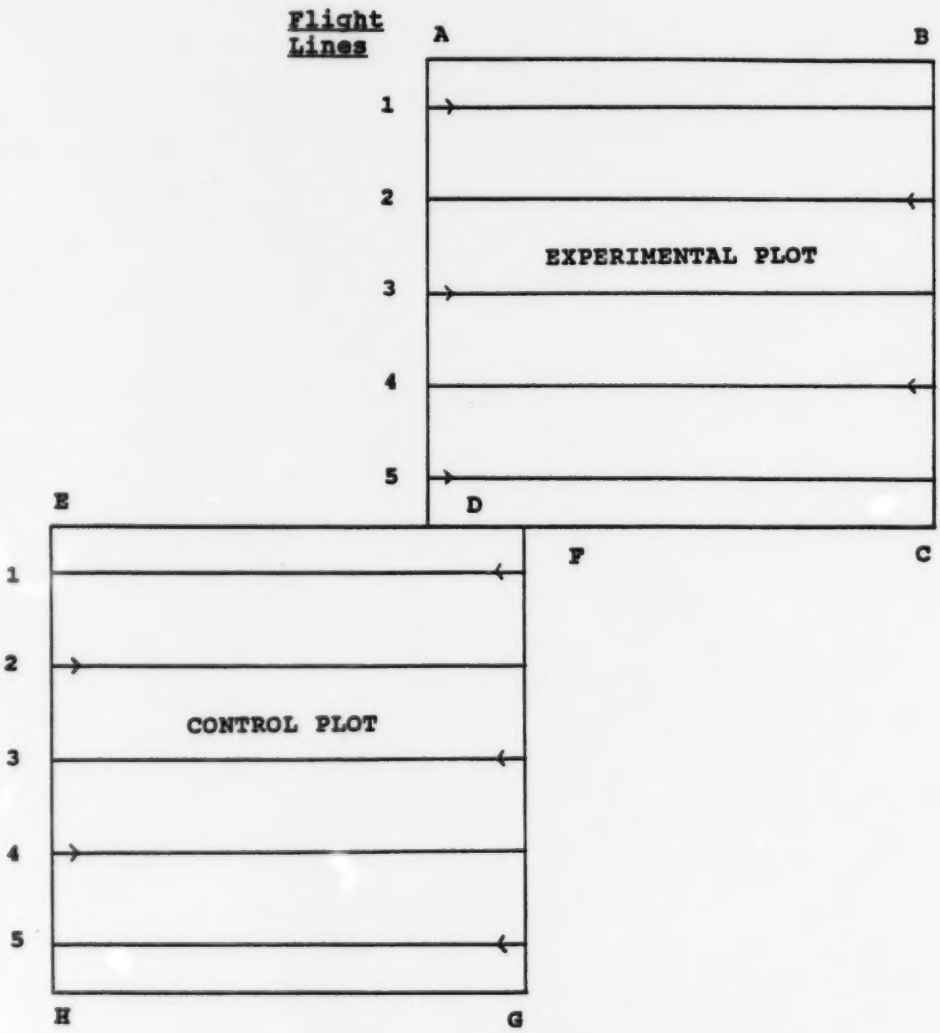


FIGURE II-2 - FLIGHT LINE LAYOUT FOR FIXED-WING AIRCRAFT SURVEYS

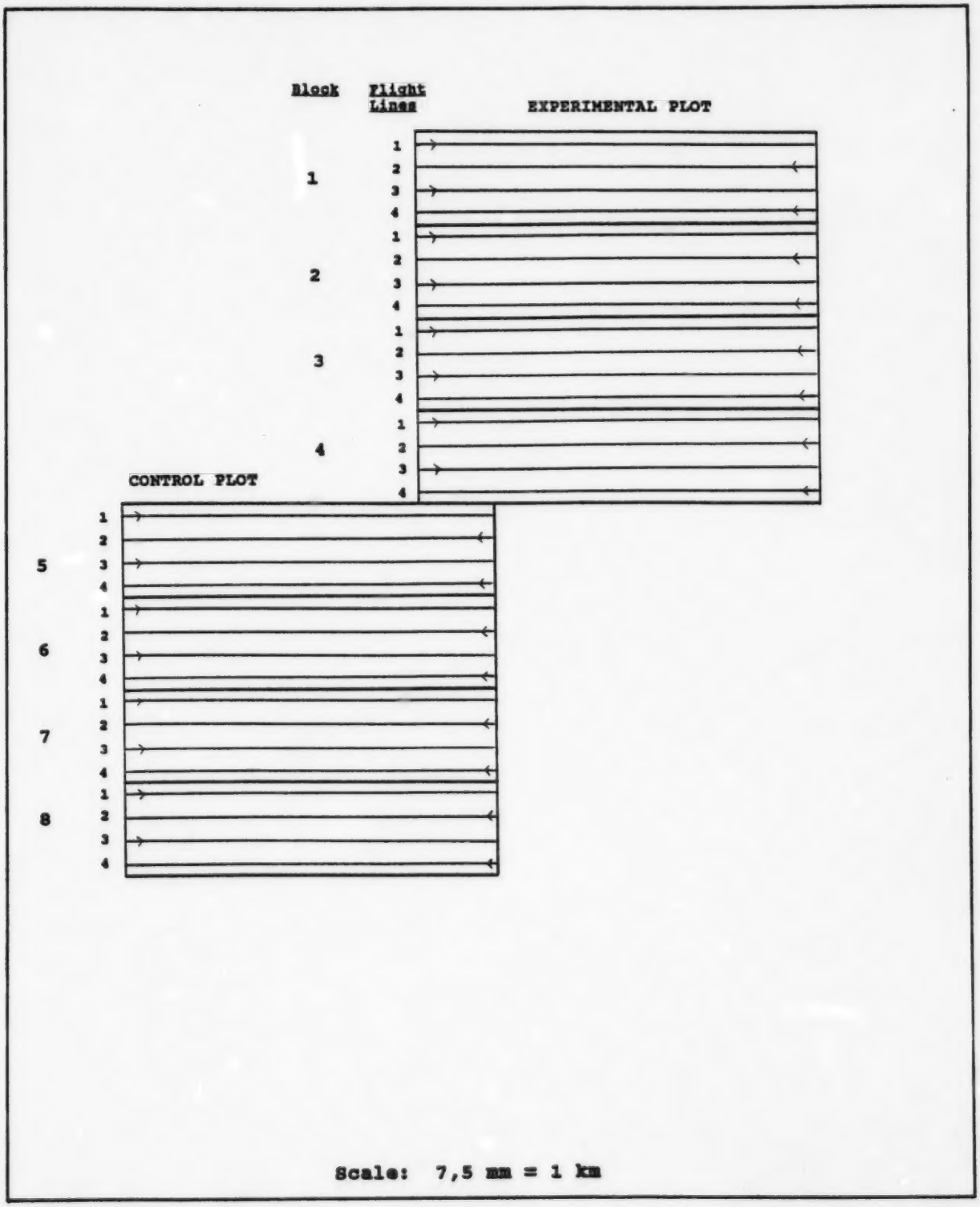


Coordinates of plot corner points

A	47-01-41; 65-00-01	E	46-56-10; 65-06-07
B	47-01-49; 64-52-08	F	46-56-19; 64-58-15
C	46-56-25; 64-51-56	G	46-50-55; 64-58-03
D	46-56-17; 64-59-49	H	46-50-47; 65-05-55

Scale: 7,5 mm = 1 km

FIGURE II-3 - FLIGHT LINE LAYOUT FOR HELICOPTER SURVEY



ANNEX B

TABLES

TABLE I-1 BREEDING PAIR SURVEYS

	Plots	Survey Dates	Black Duck			Ring-necked Duck		Common Merganser		Common Goldeneye		Pintail		Total Waterfowl		
			#	Pairs	Broods	#	Pairs	#	Pairs	#	Pairs	#	Pairs	#	Pairs	Broods
CONTROL	Control 1 (Eel River Bridge)	17-05	4	1	-	4	1	2	1	-	-	-	-	10	3	0
		26-05	1	-	-	2	-	1	-	-	-	-	-	4	0	0
	Control 2 (Baie Ste-Anne)	17-05	3	-	-	3	1	-	-	-	-	-	-	6	1	0
		26-05	4	1	1 (7cl.IA)	7	3	-	-	-	-	-	-	11	4	1
	Control 3 (Lambert Barren)	17-05	5	2	-	18	8	-	-	-	-	-	-	23	10	0
		26-05	3	-	-	9	2	2	1	1	-	1	-	16	3	0
	Totals per survey (control plots)	17-05	**12**	**3**	**0**	**25**	**10**	**2**	**1**	**0**	**0**	**0**	**0**	**39**	**14**	**0**
		26-05	**8**	**1**	**1**	**18**	**5**	**3**	**1**	**1**	**0**	**1**	**0**	**31**	**7**	**1**
EXPERIMENTAL	Thériault & Hachey (Eel River Bridge)	17-05	2	-	-	-	-	-	-	-	-	-	-	2	0	0
		26-05	-	-	-	1	-	-	-	-	-	-	-	1	0	0
	ASB (Pointe Sapin)	17-05	5	2	-	14	4	-	-	-	-	3	1	22	7	0
		26-05	9	1	1 (6cl.IA)	3	1	2	1	-	-	2	1	16	4	1
	Heveco (Tabusintac)	17-05	4	1	-	4	2	2	1	-	-	-	-	10	4	0
		26-05	7	2	-	2	1	3	1	-	-	-	-	12	4	0
	Totals per survey (experimental plots)	17-05	**11**	**3**	**0**	**18**	**6**	**2**	**1**	**0**	**0**	**3**	**1**	**34**	**11**	**0**
		26-05	**16**	**3**	**1**	**6**	**2**	**5**	**2**	**0**	**0**	**2**	**1**	**29**	**8**	**1**
	Totals per survey (all plots)	17-05	**23**	**6**	**0**	**43**	**16**	**4**	**2**	**0**	**0**	**3**	**1**	**73**	**25**	**0**
		26-05	**24**	**4**	**2**	**24**	**7**	**8**	**3**	**1**	**0**	**3**	**1**	**60**	**15**	**2**

TABLE I-2 BROOD SURVEYS

	Plots	Survey Dates	Black Duck		Ring-necked Duck		Common Merganser		Mallard		Widgeon		Total Waterfowl	
			#	Broods	#	Broods	#	Broods	#	Broods	#	Broods	#	Broods
CONTROL	Control 1 (Eel River Bridge)	27-06	-	-	-	-	-	-	-	-	-	-	0	0
		24-07	-	-	4	-	-	-	-	-	-	-	4	0
	Control 2 (Baie Ste-Anne)	27-06	1	-	1	-	-	-	-	-	-	-	2	0
		24-07	1	-	7	-	-	-	-	-	-	-	8	0
	Control 3 (Lambert Barren)	27-06	2	2 (4cl.IIB) (7cl.IB)	-	-	-	-	-	-	1	1 (4cl.IC)	3	3
		24-07	7	4 (2cl.IIB) (1cl.IIA) (4cl.IIC) (4cl.IIA)	3	1 (6cl.IC)	-	-	-	-	-	-	10	5
	Totals per survey (control plots)	**27-06**	**3**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**5**	**3**
		24-07	**8**	**4**	**14**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**22**	**5**
EXPERIMENTAL	Thériault & Hachey (Eel River Bridge)	27-06	1	-	-	-	-	-	-	-	-	-	1	0
		24-07	1	-	-	-	-	-	-	-	-	-	1	0
	ASB (Pointe Sapin)	27-06	1	-	2	-	-	-	-	-	-	-	3	0
		24-07	4	1 (5cl.IIC)	1	1 (8cl.IB)	2	-	-	-	-	-	7	2
	Heveco (Tabusintac)	27-06	1	-	-	-	18	-	-	-	-	-	19	0
		24-07	23	-	1	-	7	-	1	-	-	-	32	0
	Totals per survey (experimental plots)	**27-06**	**3**	**0**	**2**	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**23**	**0**
		24-07	**28**	**1**	**2**	**1**	**9**	**0**	**1**	**0**	**0**	**0**	**40**	**2**
	Totals per survey (all plots)	**27-06**	**6**	**2**	**3**	**0**	**18**	**0**	**0**	**0**	**1**	**1**	**28**	**3**
		24-07	**36**	**5**	**16**	**2**	**9**	**0**	**1**	**0**	**0**	**0**	**62**	**7**

TABLE I-3 STAGING AND MIGRATION SURVEYS

	Plots	Survey Dates	Black Duck	Ring-necked Duck	Common Merganser	Green-winged Teal	Blue-winged Teal	Mallard	Wood Duck	Canada Goose	Total Waterfowl
CONTROL	Control 1 (Eel River Bridge)	20-09	35	12	-	1	2	1	5	-	56
		11-10	1	29	-	5	-	-	-	-	35
		27-10	-	4	-	-	-	-	-	-	4
	Control 2 (Baie Ste-Anne)	20-09	6	32	-	-	-	-	-	-	38
		11-10	2	11	-	-	-	-	-	-	13
		27-10	-	10	-	-	-	-	-	-	10
	Control 3 (Lambert Barren)	20-09	13	7	-	-	-	-	1	-	21
		11-10	-	6	-	-	-	-	-	9	15
		27-10*	-	-	-	-	-	-	-	70	70
	Totals per survey (control plots)	**20-09**	**54**	**51**	**0**	**1**	**2**	**1**	**6**	**0**	**115**
		11-10	**3**	**46**	**0**	**5**	**0**	**0**	**0**	**9**	**63**
		27-10	**0**	**14**	**0**	**0**	**0**	**0**	**0**	**70**	**84**
EXPERIMENTAL	Thériault & Hachey (Eel River Bridge)	20-09	7	6	1	-	1	-	-	-	15
		11-10	9	6	-	2	-	-	6	35	58
		27-10	-	-	-	-	-	-	-	-	0
	ASB (Pointe Sapin)	20-09	21	-	-	5	-	-	-	-	26
		11-10	4	13	-	-	-	-	-	-	17
		27-10	-	1	-	-	-	-	-	-	1
	Heveco (Tabusintac)	20-09	12	5	1	6	11	3	-	-	38
		11-10*	-	10	-	-	-	-	-	-	10
		27-10*	-	-	-	-	-	-	-	-	0
	Totals per survey (experimental plots)	**20-09**	**40**	**11**	**2**	**11**	**12**	**3**	**0**	**0**	**79**
		11-10	**13**	**29**	**0**	**2**	**0**	**0**	**6**	**35**	**85**
		27-10	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
	Totals per survey (all plots)	**20-09**	**94**	**62**	**2**	**12**	**14**	**4**	**6**	**0**	**194**
		11-10	**16**	**75**	**0**	**7**	**0**	**0**	**6**	**44**	**148**
		27-10	**0**	**15**	**0**	**0**	**0**	**0**	**0**	**70**	**85**

TABLE I-4 SURVEY RESULTS PER PLOT
CONTROL 1 (EEL RIVER BRIDGE)

Surveys	Survey Dates	Black Duck		Ring-necked Duck		Common Merganser		Green-winged Teal	Blue-winged Teal	Mallard	Wood Duck	Total Waterfowl		
		#	Pairs	#	Pairs	#	Pairs	#	#	#	#	#	Pairs	Broods
Breeding Pair	17-05	4	1	4	1	2	1	-	-	-	-	10	3	-
	26-05	1	-	2	-	1	-	-	-	-	-	4	-	-
Brood	27-06	-	-	-	-	-	-	-	-	-	-	-	-	-
	24-07	-	-	4	-	-	-	-	-	-	-	4	-	-
Staging and Migration	20-09	35	-	12	-	-	-	1	2	1	5	56	-	-
	11-10	1	-	29	-	-	-	5	-	-	-	35	-	-
	27-10	-	-	4	-	-	-	-	-	-	-	4	-	-

TABLE I-5 SURVEY RESULTS PER PLOT
CONTROL 2 (BAIE-STE-ANNE)

Surveys	Survey Dates	Black Duck			Ring-necked Duck			Total Waterfowl		
		#	Pairs	Broods	#	Pairs	Broods	#	Pairs	Broods
Breeding Pair	17-05	3	-	-	3	1	-	6	-	-
	26-05	4	1	1 7class IA	7	3	-	11	4	1
Brood	27-06	1	-	-	1	-	-	2	-	-
	24-07	1	-	-	7	-	-	8	-	-
Staging and Migration	20-09	6	-	-	32	-	-	38	-	-
	11-10	2	-	-	11	-	-	13	-	-
	27-10	-	-	-	10	-	-	10	-	-

TABLE I-6 SURVEY RESULTS PER PLOT CONTROL 3 (LAMBERT BARREN)

Surveys	Survey Dates	Black Duck			Ring-necked Duck			Common Merganser		Common Goldeneye	Pintail	Widgeon		Wood Duck	Canada Goose	Total Waterfowl		
		#	Pairs	Broods	#	Pairs	Broods	#	Pairs	#	#	#	Broods	#	#	#	Pairs	Broods
Breeding Pair	17-05	5	2	-	18	8	-	-	-	-	-	-	-	-	-	23	10	-
	26-05	3	-	-	9	2	-	2	1	1	1	-	-	-	-	16	3	-
Brood	27-06	2	-	2 4cl.IIB 7cl.IB	-	-	-	-	-	-	-	1	1 4cl.IC	-	-	3	-	3
	24-07	7	-	4 2cl.IIB 1cl.IIA 4cl.IIC ≥4cl.IIA	3	-	6cl.IC	-	-	-	-	-	-	-	-	10	-	5
Staging and Migration	20-09	13	-	-	7	-	-	-	-	-	-	-	-	1	-	21	-	-
	11-10	-	-	-	6	-	-	-	-	-	-	-	-	-	9	15	-	-
	27-10	-	-	-	-	-	-	-	-	-	-	-	-	-	70	70	-	-

TABLE I-7 SURVEY RESULTS PER PLOT
THERIAULT & HACHEY (EEL RIVER BRIDGE)

Surveys	Survey Dates	Black Duck	Ring-necked Duck	Common Merganser	Green-winged Teal	Blue-winged Teal	Wood Duck	Canada Goose	Total Waterfowl		
		#	#	#	#	#	#	#	#	Pairs	Broods
Breeding Pair	17-05	2	-	-	-	-	-	-	2	-	-
	26-05	-	1	-	-	-	-	-	1	-	-
Brood	27-06	1	-	-	-	-	-	-	1	-	-
	24-07	1	-	-	-	-	-	-	1	-	-
Staging and Migration	20-09	7	6	1	-	1	-	-	15	-	-
	11-10	9	6	-	2	-	6	35	58	-	-
	27-10	-	-	-	-	-	-	-	-	-	-

TABLE I-8 SURVEY RESULTS PER PLOT
ASB (POINTE-SAPIN)

Surveys	Survey Dates	Black Duck			Ring-necked Duck		Common Merganser		Green-winged Teal	Pintail		Total Waterfowl		
		#	Pairs	Broods	#	Pairs	#	Pairs	#	#	Pairs	#	Pairs	Broods
Breeding Pair	17-05	5	2	-	14	4	-	-	-	3	1	27	7	-
	26-05	9	1	1 6cl.IA	3	1	2	1	-	2	1	16	4	1
Brood	27-06	1	-	-	2	-	-	-	-	-	-	3	-	-
	24-07	4	-	1 5cl.IIC	1	1 8cl.IB	2	-	-	-	-	7	-	2
Staging and Migration	20-09	21	-	-	-	-	-	-	5	-	-	26	-	-
	11-10	4	-	-	13	-	-	-	-	-	-	17	-	-
	27-10	-	-	-	1	-	-	-	-	-	-	1	-	-

TABLE I-9 SURVEY RESULTS PER PLOT HEVECO (TABUSINTAC)

Surveys	Survey Dates	Black Duck		Ring-necked Duck		Common Merganser		Green-winged Teal	Blue-winged Teal	Mallard	Total Waterfowl		
		#	Pairs	#	Pairs	#	Pairs	#	#	#	#	Pairs	Broods
Breeding Pair	17-05	4	1	4	2	2	1	-	-	-	10	4	-
	26-05	7	2	2	1	3	1	-	-	-	12	4	-
Brood	27-06	1	-	-	-	18	-	-	-	-	19	-	-
	24-07	23	-	1	-	7	-	-	-	-	32	-	-
Staging and Migration	20-09	12	-	5	-	1	-	6	11	3	38	-	-
	11-10	-	-	10	-	-	-	-	-	-	10	-	-
	27-10	-	-	-	-	-	-	-	-	-	-	-	-

TABLE II-1: MOOSE SIGHTINGS - LATE SPRING SURVEYS
Survey 1 (89 06 06)

	Line	Adult M	Adult F	Adult Unk.	Calf	Total
Experimental	1	-	-	-	-	0
	2	-	-	-	-	0
	3	-	-	-	-	0
	4	-	1	1	-	2
	5	1	1	-	1	3
TOTAL		**1**	**2**	**1**	**1**	**5**
Control	1	-	-	-	-	0
	2	1	-	-	-	1
	3	-	-	-	-	0
	4	-	1	-	-	1
	5	-	-	-	-	0
TOTAL		**1**	**1**	**0**	**0**	**2**

TABLE II-2: MOOSE SIGHTINGS - LATE SPRING SURVEYS
Survey 2 (89 06 13)

Experimental	Line	Adult M	Adult F	Adult Unk.	Calf	Total
	1	-	-	-	-	0
	2	-	-	-	-	0
	3	-	-	-	-	0
	4	-	-	-	-	0
	5	1	1	-	-	2
TOTAL		**1**	**1**	**0**	**0**	**2**
Control	1	2	-	-	-	2
	2	-	1	-	-	1
	3	-	-	-	-	0
	4	2	-	-	-	2
	5	1	-	-	-	1
TOTAL		**5**	**1**	**0**	**0**	**6**

TABLE II-3: MOOSE SIGHTINGS - LATE SUMMER SURVEYS
Survey 1 (89 08 24)

Experimental	Line	Adult M	Adult F	Adult Unk.	Calf	Total
	1	-	-	-	-	0
	2	-	-	-	-	0
	3	1	2	-	1	4
	4	-	-	-	-	0
	5	-	-	-	-	0
TOTAL		**1**	**2**	**0**	**1**	**4**
Control	1	-	-	1	-	1
	2	-	--	-	-	0
	3	-	-	-	-	0
	4	-	-	-	-	0
	5	1	-	-	-	1
TOTAL		**1**	**0**	**1**	**0**	**2**

TABLE II-4: MOOSE SIGHTINGS - LATE SUMMER SURVEYS
Survey 2 (89 09 05)

Experimental	Line	Adult M	Adult F	Adult Unk.	Calf	Total
	1	-	-	-	-	0
	2	-	-	-	-	0
	3	-	-	-	-	0
	4	-	-	-	-	0
	5	-	-	-	-	0
TOTAL		0	0	0	0	0
Control	1	-	-	-	-	0
	2	-	-	-	-	0
	3	-	-	-	-	0
	4	-	-	-	-	0
	5	1	-	-	-	1
TOTAL		1	0	0	0	1

TABLE II-6: WINTER MOOSE POPULATION CENSUS
Experimental plot

Block	Line	Adult M	Adult F	Adult Unk.	Calf	Track aggregate	Total
1	1	-	-	-	-	-	0
	2	-	-	-	-	-	0
	3	-	-	-	-	-	0
	4	-	-	-	-	-	0
2	1	-	-	-	-	-	0
	2	-	-	-	-	-	0
	3	-	-	-	-	-	0
	4	-	-	-	-	-	0
3	1	-	-	-	-	-	0
	2	-	-	-	-	-	0
	3	-	-	-	-	-	0
	4	-	-	-	-	-	0
4	1	-	-	-	-	-	0
	2	-	-	-	-	-	0
	3	Not completed					
	4						
TOTAL		0	0	0	0	0	0

TABLE II-7: WINTER MOOSE POPULATION CENSUS
Control plot

Block	Line	Adult M	Adult F	Adult Unk.	Calf	Track aggregate	Total
5	1	-	-	-	-	-	0
	2	-	-	-	-	-	0
	3	1	-	-	-	1*	3
	4	-	-	-	-	-	0
6	1	-	-	-	-	-	0
	2	-	-	-	-	-	0
	3	-	-	-	-	-	0
	4	-	-	-	-	-	0
TOTAL		**0**	**0**	**0**	**0**	**0**	**0**

*** Assumed to represent 2 moose**

Note: Blocks 7 and 8 not completed.

TABLE II-5: MOOSE HARVEST STATISTICS (1989)

Experimental area				Control area			
#	Sex	Age (yrs)	Location of Kill (parish)	#	Sex	Age (yrs)	Location of Kill (parish)
1	M	3.5	Hardwick	1	M	3.5	Glenelg
				2	M	2.5	Glenelg
				3	F	2.5	Carleton
				4	M	3.5	Carleton
				5	M	2.5	Carleton
				6	M	2.5	Carleton
				7	M	1.5	Carleton

ANNEX C

FLIGHT LINE COORDINATES

WINTER MOOSE CENSUS

ANNEX C

FLIGHT LINE COORDINATES - WINTER MOOSE CENSUS

GEODETIC COMPUTATIONS FOR NEW BRUNSWICK

****

ESCUMINAC MOOSE SURVEY

	POINT #	X-COORD. (UTM27)	Y-COORD. (UTM27)	LATITUDE (NAD27)	LONGITUDE (NAD27)
	1	348000.000	5209700.000	47 1 31.12241	65 0 .85872
	2	358000.000	5209700.000	47 1 39.12367	64 52 7.38525
	3	358000.000	5209050.000	47 1 18.07779	64 52 6.65062
	4	348000.000	5209050.000	47 1 10.07815	65 0 .07248
Block 1	5	348000.000	5208450.000	47 0 50.65266	64 59 59.34693
	6	358000.000	5208450.000	47 0 58.65079	64 52 5.97271
	7	359000.000	5207800.000	47 0 37.60486	64 52 5.23853
	8	348000.000	5207800.000	47 0 29.60835	64 59 58.56116
	9	348000.000	5207200.000	47 0 10.18281	64 59 57.83606
	10	358000.000	5207200.000	47 0 18.17782	64 52 4.56103
	11	358000.000	5206550.000	46 59 57.13184	64 52 3.82730
	12	348000.000	5206550.000	46 59 49.13845	64 59 57.05076
Block 2	13	348000.000	5205950.000	46 59 29.71287	64 59 56.32609
	14	358000.000	5205950.000	46 59 37.70476	64 52 3.15020
	15	358000.000	5205300.000	46 59 16.65873	64 52 2.41691
	16	348000.000	5205300.000	46 59 8.66847	64 59 55.54126
	17	348000.000	5204700.000	46 58 49.24284	64 59 54.81703
	18	358000.000	5204700.000	46 58 57.23160	64 52 1.74022
	19	358000.000	5204050.000	46 58 36.18553	64 52 1.00737
	20	348000.000	5204050.000	46 58 28.19839	64 59 54.03268
Block 3	21	348000.000	5203450.000	46 58 8.77272	64 59 53.30888
	22	358000.000	5203450.000	46 58 16.75836	64 52 .33109
	23	358000.000	5202800.000	46 57 55.71224	64 51 59.59868
	24	348000.000	5202800.000	46 57 47.72822	64 59 52.52500
	25	348000.000	5202200.000	46 57 28.30251	64 59 51.80163
	26	358000.000	5202200.000	46 57 36.28503	64 51 58.92281
	27	358000.000	5201550.000	46 57 15.23886	64 51 58.19083
	28	348000.000	5201550.000	46 57 7.25796	64 59 51.01822
Block 4	29	348000.000	5200950.000	46 56 47.83221	64 59 50.29530
	30	358000.000	5200950.000	46 56 55.81161	64 51 57.51537
	31	358000.000	5200300.000	46 56 34.76540	64 51 56.78384
	32	348000.000	5200300.000	46 56 26.78761	64 59 49.51236

	33	340000.000	5199700.000	46	56	.59074	65	6	6.89318
	34	350000.000	5199700.000	46	56	9.00041	64	58	14.25817
	35	350000.000	5199050.000	46	55	47.95544	64	58	13.48597
Block 5	36	340000.000	5199050.000	46	55	39.54747	65	6	6.06963
	37	340000.000	5198450.000	46	55	20.12290	65	6	5.30966
	38	350000.000	5198450.000	46	55	28.52929	64	58	12.77340
	39	350000.000	5197800.000	46	55	7.48427	64	58	12.00167
	40	340000.000	5197800.000	46	54	59.07958	65	6	4.48661
	41	340000.000	5197200.000	46	54	39.65496	65	6	3.72709
	42	350000.000	5197200.000	46	54	48.05807	64	58	11.28952
	43	350000.000	5196550.000	46	54	27.01300	64	58	10.51826
Block 6	44	340000.000	5196550.000	46	54	18.61160	65	6	2.90454
	45	340000.000	5195950.000	46	53	59.18694	65	6	2.14548
	46	350000.000	5195950.000	46	54	7.58676	64	58	9.80653
	47	350000.000	5195300.000	46	53	46.54165	64	58	9.03573
	48	340000.000	5195300.000	46	53	38.14353	65	6	1.32342
	49	340000.000	5194700.000	46	53	18.71882	65	6	.56482
	50	350000.000	5194700.000	46	53	27.11537	64	58	8.32444
	51	350000.000	5194050.000	46	53	6.07021	64	58	7.55411
Block 7	52	340000.000	5194050.000	46	52	57.67537	65	5	59.74325
	53	340000.000	5193450.000	46	52	38.25061	65	5	58.98511
	54	350000.000	5193450.000	46	52	46.64388	64	58	6.84324
	55	350000.000	5192800.000	46	52	25.59867	64	58	6.07337
	56	340000.000	5192800.000	46	52	17.20711	65	5	58.16403
	57	340000.000	5192200.000	46	51	57.78231	65	5	57.40635
	58	350000.000	5192200.000	46	52	6.17230	64	58	5.36293
	59	350000.000	5191550.000	46	51	45.12704	64	58	4.59352
Block 8	60	340000.000	5191550.000	46	51	36.73876	65	5	56.58576
	61	340000.000	5190950.000	46	51	17.31392	65	5	55.82853
	62	350000.000	5190950.000	46	51	25.70063	64	58	3.88351
	63	350000.000	5190300.000	46	51	4.65533	64	58	3.11456
	64	340000.000	5190300.000	46	50	56.27032	65	5	55.00845